

DTIC**ELECTE****MAR 31 1993****AD-A262 471****1****CHAPTER 16. WHITECAP MEASUREMENTS**

by

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Video Cameras and tape recorders were installed on research vessels taking part in the Gulf of Alaska experiments to collect the data necessary for the determination of the fraction of the sea surface covered by Stage A Whitecaps (spilling wave crests). Two systems were installed; one on the R/V CORY CHOUEST and the other on the R/V J.P. TULLEY. Each system consisted of two NTSC format video cameras, VHS tape recorders, monitors, and date/time encoders. The cameras were mounted high in each ship's superstructure, and the cameras depressed to view the surface of the ocean from just above the horizon to the near sea surface at the bottom of the picture. Time was encoded to allow synchronization of recorded events with other recorded parameters. Video images were recorded during daylight hours for the days on station. The VHS format recorder allowed continuous recording for a period of eight hours. This data set was by far the largest we at the Marine Sciences Institute have been able to collect and analyze. It provides the basis for an assessment of how whitecap coverage varies as the wind conditions change.

All equipment and the data tapes were removed from the vessels and shipped to the University of Connecticut by Johns Hopkins Personnel.

At the Marine Sciences Institute, Groton, Connecticut, analysis of video tapes from the R/V CORY CHOUEST and from the Canadian R/V J.P. TULLEY was accomplished using the PC Vision Frame Grabber boards, and software developed at the Marine Sciences Institute by Dr. Wang Qin.

Tapes to be analyzed were played in a JVC Video Cassette Recorder, Model BR-3200U, and the video signal sent to the ITEX/PC Vision Frame Grabber, and in parallel, to a JVC TM-9U color video monitor. This monitor allows the operator to view the video signal as recorded. The frame grabber "captures" a video frame, and stores it in a NECA 486-33Mhz IBM compatible computer for analysis.

Dr. Wang Qin, working in "C" language, developed an algorithm to control the area of analysis, compare gray scale pixel values, and discriminate between "sky", water, and by judicious selection of gray scale values, Stage "A" Whitecaps, and Stage "A" plus Stage "B" Whitecaps. This system has been compared to the Hamamatsu Analysis procedures, and has been

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found to be comparable, and to have several advantages.

Using the Hamamatsu system, an area of the monitor screen, representing the area of analysis is selected. This area is often small when compared to the screen size due to the sky effect. The Hamamatsu Area Analyzer counts all pixels with a gray scale value lighter than a threshold, which has to be set by the operator. Some of the parameters which effect the threshold setting are: time and brightness of the day; sun-light or over-cast conditions; and sun position, roughness and specular reflections from the water surface. During analysis, the roll of the ship platform often brings a portion of the sky into the picture. If the "sky" intrudes into the area selected for analysis, an error is generated in the whitecap fraction, as the "sky" will be counted as whitecap. Thus, for an analysis interval, the analysis area often has to be drastically reduced to preclude this error.

Using the frame grabber, gray scale values of all pixels are determined, and sent to the computer. These values are compared to locate the interface of "sky" and water. The "sky" portion of the video frames are then excluded from further consideration in the computation of the whitecap fraction. The left, right and lower bounds of the analysis area are set by the operator. The upper bound is controlled by the computer analysis of the "sky" interface, thus the area considered for determining the whitecap fraction is maximized.

In determining exactly which pixels will be counted, the operator has control of two thresholds. One controls the maximum brightness of the "sky", the other sets the minimum brightness of the stage "A" whitecap. Choosing still lower minimum brightness values allows one to count (stage "A" + stage "B") whitecaps.

The analyzed video frame from the computer is sent back through the frame grabber with the gray scale value of the pixels counted as whitecap modified to an intense white value. The entire video picture is then presented on a second JVC TM-9U monitor, so the operator can observe in real time the pixels included in the whitecap fraction.

The standard NTSC video system will paint sixty scans of the video image, using alternate scan lines on the video monitor, each second, thus giving thirty complete images. Using the Hamamatsu system, we were able to analyze thirty complete images each second. Due to the time necessary for frame grabbing, analysis of the "sky", additional analysis of the remainder of the video presentation, computer access time, and computer cycle time to calculate and store one second averages, the frame grabber system is reduced to calculating the one second whitecap averages based on looking at only five video

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frames each second. This is considered more than adequate for computing one second whitecap average fractions.

The accuracy of this system of analysis is still based to some extent on operator judgment. There are also some problems caused by the changing parameters such as reflections of sunlight, etc. To minimize these, the operator has control over adjustment of both the sky and whitecap thresholds during the entire data processing event.

It is envisioned that the next generation of analysis equipment will be much faster, being able to analyze every video frame; more accurate, in that the parameters will be based only on physical conditions, and not on operator judgments; and that the entire data acquisition system will be made more adaptable to use at sea, and in the air from a variety of platforms.

In working with the video tapes from the CORY CHOUEST, and the J.P. TULLEY, several checks were done to ensure uniformity of operators, and results. Several analysis intervals were done on both the Hamamatsu Area Analyzer and on the P.C. Vision Frame Grabber. The results were compared and found to be in agreement. In addition, different operators were required to analyze several identical segments on the same tapes for comparison. Again, the results were in very good agreement.

Not all tapes were able to be analyzed. This was due to several factors such as rain or salt spray that appeared on the camera windows, as a result of sea and weather conditions. Specular reflections also interfered with analysis. In some segments there was insufficient light at the start or end of the recording day.

In all, this effort resulted in the largest data sets from ships at sea thus far analyzed. One hundred twenty one intervals from the CORY CHOUEST (Eighty-eight original, thirty-three supplemental) were analyzed, one hundred eighty three (Revised) from the J.P. TULLEY were processed.

The results are presented in three tables, along with several representative graphs of the Log of the Stage A Whitecap Fraction (one second averages + 0.0001) verses time, for 600 second periods. Included with the graphs is the relevant information as to the ship, tape, Julian day and year, and the meteorological data from the 17 December, 1992, as updated by JHU/APL. The analysis interval start times were based upon analysis constraints rather than on artificial clock constraints. Where possible consecutive ten minute sequences were analyzed, and as a result, there are several periods with continuous analysis results for as long as seventy minutes. The time for the meteorological data utilized in the analysis

was the average for the period just prior to the analysis start.

The results of this work are presented only for PHASE II of the Experiment, as the meteorological data for PHASES I and III are not yet available.

WHITECAP DATA SET NO:

DATA TYPE: WA

SOURCE: GULF OF ALASKA, FEBRUARY / MARCH, 1992
VIDEO DATA FROM RESEARCH VESSEL CORY CHOUEST

CITATION:

NUMBER OF OBSERVATIONS: EIGHTY-EIGHT

JULIAN DAY 55, TAPE #13

| OBN | U10 | WD | ATEMP | WTEMP | WFRAC |
|----------|------|-------|-------|-------|-----------|
| RV1-1756 | 9.6 | 184.2 | 6.7 | 5.4 | 0.0005245 |
| RV1-1826 | 9.1 | 191.0 | 6.6 | 5.4 | 0.0015848 |
| RV1-1856 | 10.0 | 188.6 | 6.8 | 5.5 | 0.0012460 |
| RV1-1926 | 9.5 | 190.1 | 6.8 | 5.5 | 0.0008314 |
| RV1-1956 | 8.1 | 187.9 | 6.7 | 5.5 | 0.0001773 |
| RV1-2026 | 8.3 | 186.6 | 6.8 | 5.6 | 0.0005520 |
| RV1-2056 | 9.0 | 185.8 | 7.0 | 5.7 | 0.0017131 |
| RV1-2126 | 8.4 | 185.1 | 6.9 | 5.8 | 0.0005764 |
| RV1-2156 | 8.8 | 185.8 | 6.9 | 5.8 | 0.0006399 |
| RV1-2226 | 8.1 | 192.0 | 6.9 | 5.7 | 0.0006765 |
| RV1-2256 | 7.5 | 188.1 | 6.9 | 5.7 | 0.0002347 |
| RV1-2326 | 7.7 | 189.4 | 6.9 | 5.7 | 0.0002711 |
| RV1-2356 | 5.6 | 208.0 | 6.9 | 5.7 | 0.0000979 |

JULIAN DAY 56

| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-0026 | 3.5 | 236.7 | 6.7 | 5.7 | 0.0003330 |
| RV1-0056 | 4.1 | 229.6 | 6.9 | 5.8 | 0.0000255 |
| RV1-0126 | 3.3 | 238.0 | 6.9 | 5.9 | 0.0002620 |

JULIAN DAY 56, TAPE #14

| | | | | | |
|----------|------|------|-----|-----|-----------|
| RV1-1718 | 14.9 | 13.4 | 4.1 | 5.3 | 0.0028182 |
|----------|------|------|-----|-----|-----------|

JULIAN DAY 57, TAPE #15

| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-0334 | 1.8 | 227.5 | 6.4 | 5.6 | 0.0001507 |
|----------|-----|-------|-----|-----|-----------|

JULIAN DAY 57, TAPE #16

| | | | | | |
|----------|------|-------|-----|-----|-----------|
| RV1-1700 | 11.2 | 283.8 | 3.1 | 5.2 | 0.0004848 |
| RV1-1730 | 12.0 | 283.6 | 3.0 | 5.2 | 0.0004755 |
| RV1-1800 | 8.9 | 270.4 | 3.0 | 5.2 | 0.0005843 |
| RV1-1830 | 5.7 | 310.5 | 1.9 | 5.4 | 0.0004628 |
| RV1-1900 | 8.2 | 271.3 | 3.6 | 5.3 | 0.0010653 |
| RV1-1930 | 9.4 | 289.7 | 3.5 | 5.3 | 0.0003071 |
| RV1-2000 | 8.0 | 305.6 | 3.3 | 5.3 | 0.0006975 |

| OBN | U10 | WD | ATEMP | WTEMP | WFRAC |
|-------------------------------|------|-------|-------|-------|-----------|
| JULIAN DAY 57, TAPE #16 CONT. | | | | | |
| RV1-2030 | 10.4 | 285.4 | 3.2 | 5.5 | 0.0003160 |
| RV1-2100 | 8.8 | 284.4 | 2.3 | 5.4 | 0.0005778 |
| RV1-2130 | 5.5 | 280.6 | 2.9 | 5.6 | 0.0000342 |
| RV1-2200 | 6.6 | 297.7 | 3.4 | 5.7 | 0.0002257 |
| RV1-2230 | 6.0 | 311.2 | 3.6 | 5.8 | 0.0003225 |

JULIAN DAY 57, TAPE #17

| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-2308 | 5.9 | 329.1 | 3.2 | 5.7 | 0.0000193 |
| RV1-2338 | 5.1 | 326.6 | 3.3 | 5.7 | 0.0000102 |

JULIAN DAY 58

| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-0008 | 3.5 | 326.0 | 3.3 | 5.7 | 0.0000049 |
| RV1-0038 | 6.6 | 305.5 | 3.0 | 5.7 | 0.0000657 |
| RV1-0108 | 7.8 | 307.5 | 2.5 | 5.7 | 0.0002418 |
| RV1-0138 | 6.5 | 305.7 | 2.7 | 5.8 | 0.0008910 |
| RV1-0208 | 5.0 | 326.2 | 3.1 | 5.8 | 0.0000892 |
| RV1-0238 | 5.1 | 352.8 | 3.3 | 5.7 | 0.0019790 |
| RV1-0308 | 4.8 | 351.0 | 3.3 | 5.7 | 0.0013622 |
| RV1-0338 | 4.8 | 350.2 | 3.2 | 5.6 | 0.0000330 |

JULIAN DAY 58, TAPE #18

| | | | | | |
|----------|------|-------|-----|-----|-----------|
| RV1-1640 | 9.1 | 319.6 | 2.8 | 5.5 | 0.0006555 |
| RV1-1710 | 7.9 | 318.5 | 2.6 | 5.4 | 0.0048386 |
| RV1-1740 | 9.5 | 339.9 | 2.1 | 5.3 | 0.0012790 |
| RV1-1840 | 10.0 | 284.2 | 2.2 | 5.2 | 0.0006834 |
| RV1-1910 | 11.2 | 302.7 | 2.5 | 5.3 | 0.0009044 |
| RV1-1940 | 12.1 | 291.0 | 1.9 | 5.3 | 0.0003393 |
| RV1-2010 | 9.4 | 299.1 | 1.3 | 5.4 | 0.0009487 |
| RV1-2040 | 11.2 | 316.6 | 1.2 | 5.5 | 0.0015495 |
| RV1-2110 | 7.8 | 303.5 | 1.6 | 5.6 | 0.0001239 |
| RV1-2140 | 10.3 | 299.9 | 2.7 | 5.6 | 0.0015653 |
| RV1-2240 | 7.5 | 289.8 | 3.0 | 5.7 | 0.0003009 |

JULIAN DAY 58, TAPE #19

| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-2302 | 7.4 | 288.2 | 2.8 | 5.6 | 0.0004559 |
|----------|-----|-------|-----|-----|-----------|

JULIAN DAY 59

| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-0048 | 6.6 | 284.5 | 2.9 | 5.4 | 0.0000007 |
| RV1-0208 | 4.9 | 266.7 | 2.8 | 5.3 | 0.0001188 |
| RV1-0238 | 5.6 | 302.9 | 2.7 | 5.3 | 0.0002610 |
| RV1-0308 | 5.7 | 277.1 | 2.7 | 5.3 | 0.0000001 |
| RV1-0338 | 5.4 | 268.6 | 2.7 | 5.3 | 0.0000003 |

| OBN | U10 | WD | ATEMP | WTEMP | WFRAC |
|-------------------------|-----|-------|-------|-------|-----------|
| JULIAN DAY 59, TAPE #20 | | | | | |
| RV1-1700 | 4.6 | 155.9 | 3.2 | 5.5 | 0.0000000 |
| RV1-1730 | 5.5 | 159.4 | 3.2 | 5.5 | 0.0000019 |
| RV1-1800 | 4.1 | 130.1 | 2.9 | 5.5 | 0.0000079 |
| RV1-1830 | 4.6 | 137.1 | 3.1 | 5.5 | 0.0000001 |
| RV1-1900 | 6.8 | 147.0 | 3.3 | 5.5 | 0.0000310 |
| RV1-1930 | 5.2 | 156.1 | 3.4 | 5.5 | 0.0000162 |
| RV1-2000 | 6.9 | 158.6 | 4.1 | 5.6 | 0.0000149 |
| RV1-2030 | 7.1 | 153.7 | 4.3 | 5.6 | 0.0001157 |

JULIAN DAY 60, TAPE #21

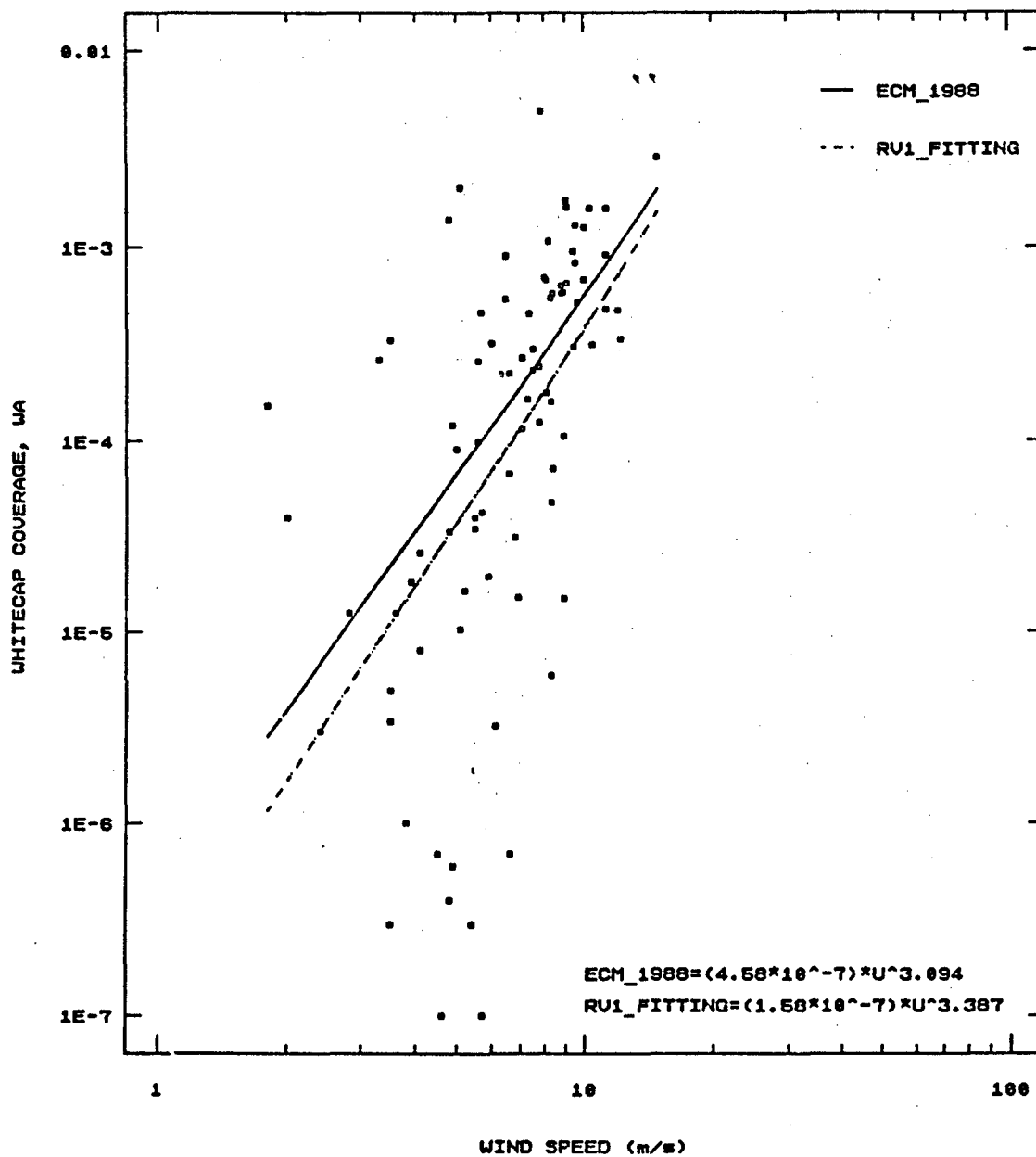
| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-0100 | 8.3 | 153.1 | 5.2 | 5.4 | 0.0000059 |
| RV1-0130 | 8.9 | 146.9 | 4.9 | 5.4 | 0.0000147 |
| RV1-0200 | 8.4 | 151.7 | 4.8 | 5.3 | 0.0000710 |
| RV1-0230 | 8.3 | 146.6 | 4.9 | 5.3 | 0.0001598 |
| RV1-0300 | 8.9 | 144.9 | 4.9 | 5.2 | 0.0001045 |
| RV1-0330 | 8.3 | 141.4 | 5.0 | 5.2 | 0.0000468 |

JULIAN DAY 60, TAPE #22

| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-1700 | 7.3 | 140.2 | 5.6 | 5.5 | 0.0001648 |
| RV1-1730 | 6.5 | 142.5 | 5.6 | 5.4 | 0.0005443 |
| RV1-1800 | 6.3 | 145.9 | 5.6 | 5.3 | 0.0002208 |
| RV1-1830 | 5.5 | 150.7 | 5.8 | 5.4 | 0.0000389 |
| RV1-1900 | 6.1 | 164.5 | 5.8 | 5.4 | 0.0000032 |
| RV1-1930 | 5.7 | 164.8 | 5.6 | 5.3 | 0.0000415 |
| RV1-2045 | 4.8 | 159.3 | 5.6 | 5.3 | 0.0000004 |
| RV1-2255 | 3.5 | 158.6 | 5.8 | 5.4 | 0.0000003 |
| RV1-2325 | 3.8 | 169.5 | 5.7 | 5.4 | 0.0000010 |
| RV1-2355 | 2.0 | 170.5 | 5.7 | 5.4 | 0.0000390 |

JULIAN DAY 61, TAPE #23

| | | | | | |
|----------|-----|-------|-----|-----|-----------|
| RV1-0017 | 3.6 | 206.5 | 5.7 | 5.4 | 0.0000124 |
| RV1-0047 | 4.9 | 199.3 | 5.5 | 5.5 | 0.0000006 |
| RV1-0117 | 4.5 | 195.3 | 5.4 | 5.5 | 0.0000007 |
| RV1-0147 | 3.9 | 194.7 | 5.5 | 5.5 | 0.0000180 |
| RV1-0217 | 3.5 | 184.8 | 5.4 | 5.5 | 0.0000034 |
| RV1-0247 | 2.8 | 158.4 | 5.5 | 5.5 | 0.0000125 |
| RV1-0317 | 2.4 | 191.3 | 5.5 | 5.4 | 0.0000030 |



ANALYSIS OF RESEARCH VESSEL ONE DATA

TAPE/EVENT NUMBER :RV1-1718 YR/JUL DAY :1992/56 START TIME : 1718

WHITECAP AVERAGE : 0.0028182 VARIANCE : 0.0000874
SKEWNESS : 7.2874822 KURTOSIS : 66.6426393

METEROLOGICAL DATA :

W_S(m/s)
14.9

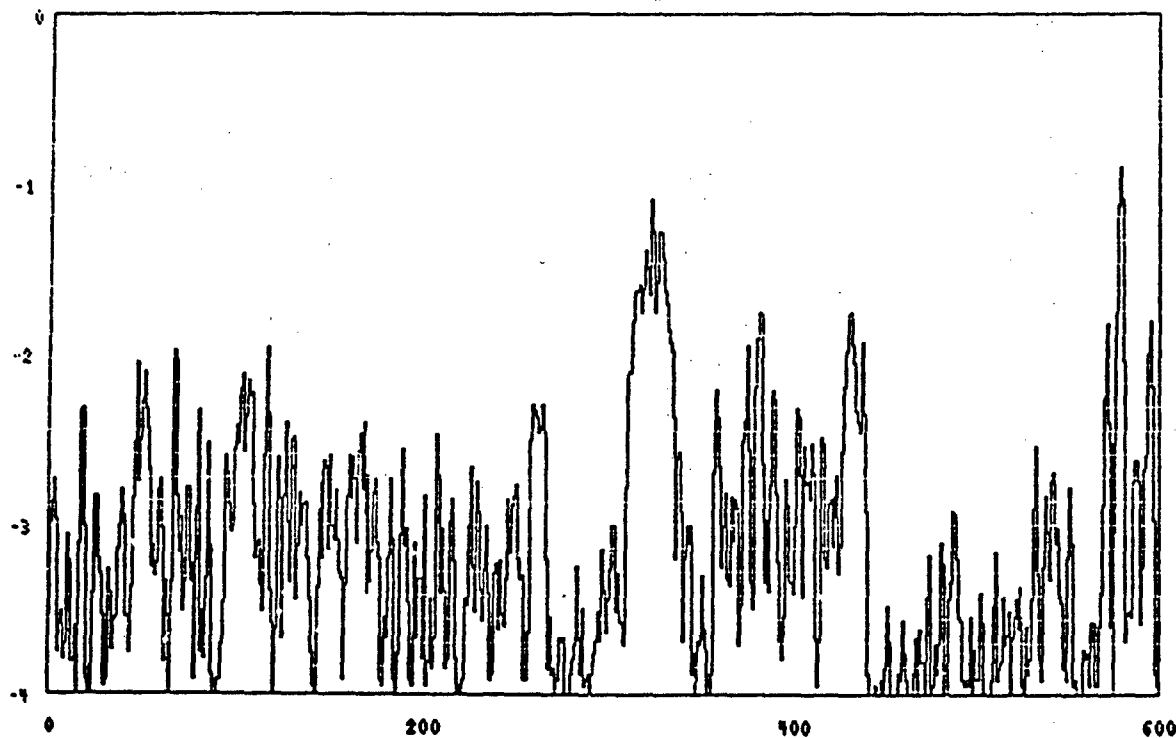
W_D
13.4

T_air
4.1

T_water
5.3

STABILITY
UNSTABLE

LogH vs Time



Time (seconds)

ANALYSIS OF RESEARCH VESSEL ONE DATA

TAPE/EVENT NUMBER :RV1-0334 YR/JUL DAY :1992/57 START TIME : 0334

WHITECAP AVERAGE : 0.0001507
SKEWNESS : 12.0700594

VARIANCE : 0.0000009
KURTOSIS :183.3030686

METEROLOGICAL DATA :

W_s(m/s)
1.8

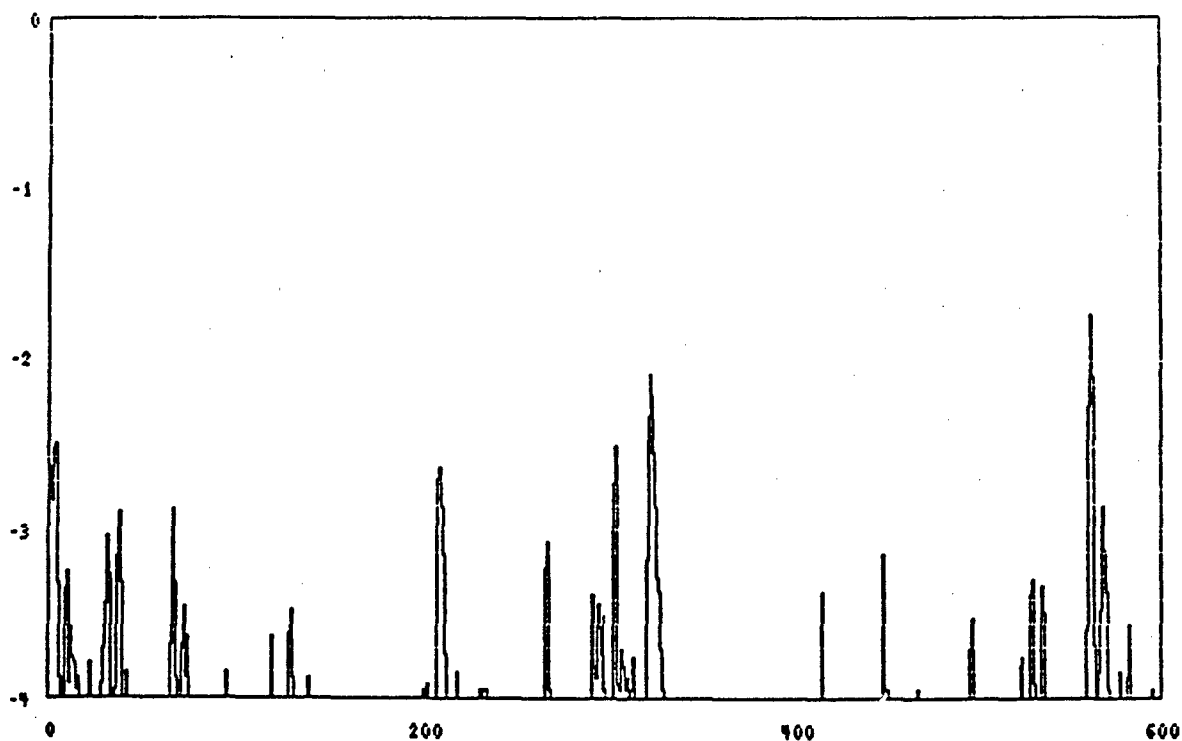
W_D
227.5

T_{air}
6.4

T_{water}
5.6

STABILITY
STABLE

LogH vs Time



Time (seconds)

Supplement #1

23 November, 1992

The listed whitecap fractions included in this report are supplemental to those provided in the original report dated August, 1992, and consist of thirty-three additional intervals analyzed since the issue of that report. The numbering sequences have been augmented to reflect the vessel, RV1, the tape sequence number, the file name, and a dash (-) number. The file name consists of the four digit ZULU time of the start of the analysis interval. When possible, the analysis period consisted of thirty minutes of continuous operation. These periods were further broken down into ten minute periods for processing, and for graphing. Thus, "-1" indicates the ten minute interval starting at the file specified time, and a "-3" indicates the third ten minute period of the thirty minute interval.

We have also included in the tabular report the standard deviation of the one second averages used in computing the whitecap fraction.

A plot of the expected fitted line and the actual fitted line are also provided.

SOURCE: GULF OF ALASKA, FEBRUARY / MARCH, 1992

VIDEO DATA FROM RESEARCH VESSEL CORY CHOUEST

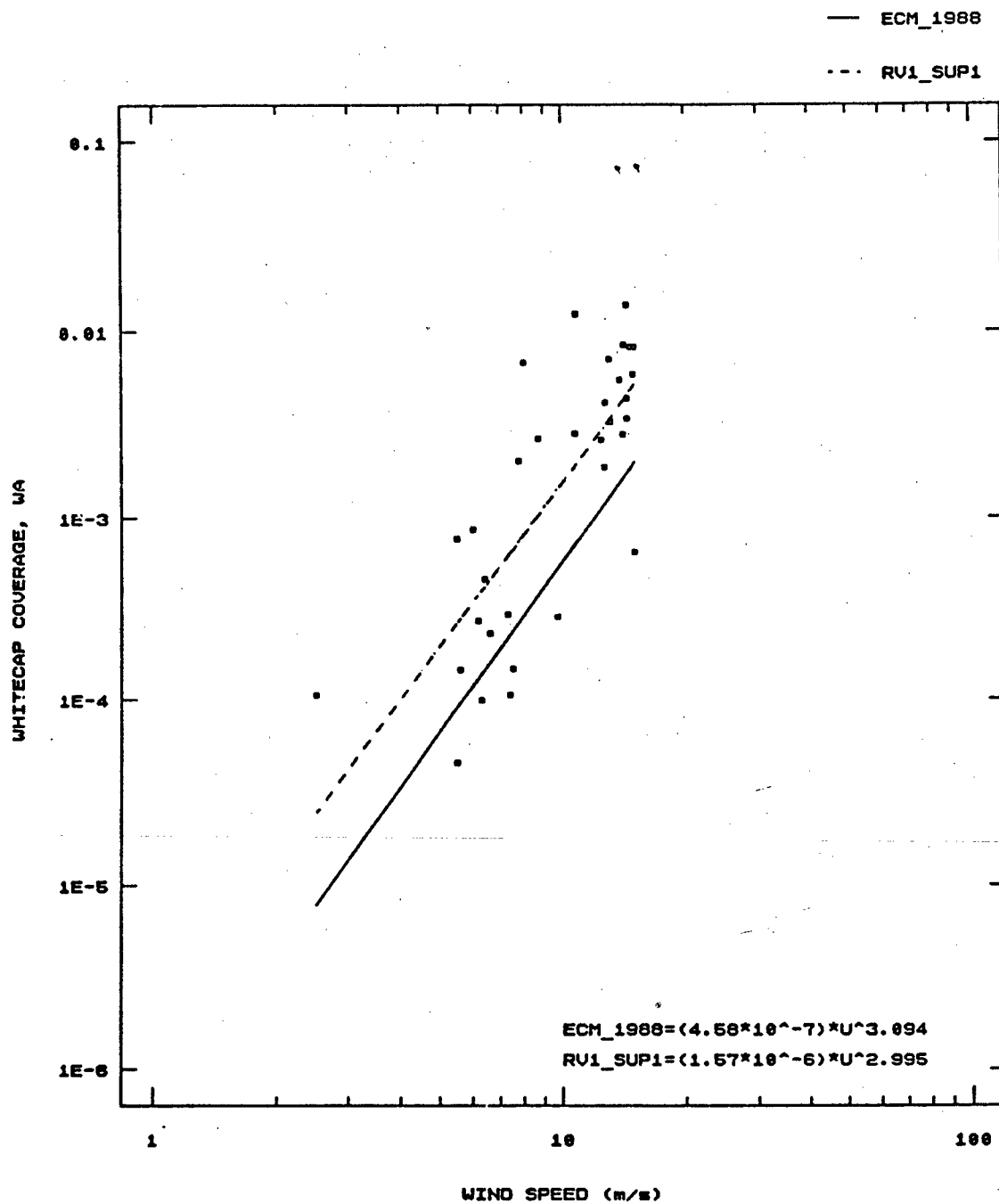
CITATION: (RV1 Suppliment #1, DTD 18 NOVEMBER, 1992)

NUMBER OF OBSERVATIONS: 33

| ORN | START TIME | DURATION SECS | U10 M/S | WD DEG | ATEMP DEG C | WTEMP DEG C | WFRAC | STD.DEV. |
|--------------------------|---------------|------------------|------------|-----------|----------------|----------------|-----------|-----------|
| JULIAN DAY: 55, TAPE #13 | | | | | | | | |
| RV1-13/1751-1 | 1751 | 329 | 9.7 | 184.2 | 6.7 | 5.4 | 0.0002793 | 0.0308630 |
| JULIAN DAY: 55, TAPE#13 | | | | | | | | |
| RV1-13/0156-1 | 0156 | 473 | 2.5 | 308.3 | 6.4 | 5.9 | 0.0001052 | 0.0215025 |
| JULIAN DAY: 56, TAPE #14 | | | | | | | | |
| RV1-14/1713-2 | 1728 | 437 | 15.0 | 13.4 | 4.1 | 5.3 | 0.0006327 | 0.0373464 |
| RV1-14/1808-1 | 1808 | 601 | 12.6 | 12.9 | 4.1 | 5.3 | 0.0018641 | 0.0691036 |
| RV1-14/1818-1 | 1818 | 601 | 12.4 | 17.7 | 4.2 | 5.3 | 0.0026360 | 0.0825967 |
| RV1-14/1836-1 | 1836 | 590 | 12.7 | 15.3 | 4.2 | 5.3 | 0.0041805 | 0.1017439 |
| RV1-14/1907-1 | 1907 | 601 | 13.0 | 15.6 | 4.3 | 5.4 | 0.0070373 | 0.1413512 |
| RV1-14/1927-1 | 1927 | 601 | 13.1 | 17.0 | 4.3 | 5.5 | 0.0032985 | 0.0920474 |
| RV1-14/1937-1 | 1937 | 601 | 14.0 | 15.2 | 4.2 | 5.6 | 0.0028017 | 0.0777084 |
| RV1-14/2007-1 | 2007 | 601 | 14.4 | 15.8 | 4.2 | 5.7 | 0.0135544 | 0.1731999 |
| RV1-14/2007-2 | 2017 | 601 | 14.4 | 20.6 | 4.3 | 5.7 | 0.0043953 | 0.0870834 |
| RV1-14/2007-3 | 2027 | 601 | 14.4 | 20.6 | 4.3 | 5.7 | 0.0034233 | 0.0823759 |
| RV1-14/2037-1 | 2037 | 601 | 13.8 | 7.9 | 4.3 | 5.7 | 0.0054935 | 0.1011606 |
| RV1-14/2037-2 | 2047 | 601 | 14.9 | 5.9 | 4.3 | 5.7 | 0.0058868 | 0.1100105 |
| RV1-14/2110-1 | 2110 | 601 | 14.6 | 12.8 | 4.3 | 5.7 | 0.0081470 | 0.1251909 |
| RV1-14/2140-1 | 2140 | 601 | 14.1 | 17.9 | 4.4 | 5.7 | 0.0084209 | 0.1196893 |
| RV1-14/2210-1 | 2210 | 601 | 15.0 | 25.4 | 4.5 | 5.7 | 0.0081491 | 0.1175594 |
| JULIAN DAY: 57, TAPE #15 | | | | | | | | |
| RV1-15/0235-1 | 0235 | 601 | 6.0 | 157.2 | 6.8 | 5.3 | 0.0008467 | 0.0504163 |
| RV1-15/0235-2 | 0245 | 600 | 5.5 | 155.8 | 6.8 | 5.3 | 0.0007496 | 0.0532648 |
| JULIAN DAY: 58, TAPE #18 | | | | | | | | |
| RV1-18/1640-2 | 1650 | 601 | 7.8 | 328.4 | 2.0 | 5.5 | 0.0020197 | 0.0722405 |
| RV1-18/1640-3 | 1700 | 596 | 8.0 | 318.5 | 2.6 | 5.4 | 0.0068031 | 0.1036333 |
| RV1-18/1810-1 | 1810 | 513 | 8.7 | 319.4 | 2.4 | 5.3 | 0.0026598 | 0.0701825 |
| RV1-18/2140-2 | 2150 | 601 | 10.8 | 293.1 | 2.8 | 5.7 | 0.0121401 | 0.1257245 |
| RV1-18/2140-3 | 2200 | 300 | 10.7 | 325.8 | 2.4 | 5.8 | 0.0028629 | 0.0613402 |
| RV1-18/2240-2 | 2250 | 601 | 7.5 | 293.9 | 2.9 | 5.6 | 0.0001449 | 0.0272434 |

JULIAN DAY: 60, TAPE #22

| OBN | START TIME | DURATION SECS | U10 M/S | WD DEG | ATEMP DEG C | WTEMP DEG C | WFRAC | STD.DEV. |
|---------------|---------------|------------------|------------|-----------|----------------|----------------|-----------|-----------|
| RV1-22/1700-2 | 1710 | 601 | 7.4 | 140.2 | 5.6 | 5.5 | 0.0001054 | 0.0190164 |
| RV1-22/1700-3 | 1720 | 597 | 7.3 | 141.4 | 5.6 | 5.4 | 0.0002876 | 0.0317245 |
| RV1-22/1730-2 | 1740 | 601 | 6.6 | 142.5 | 5.6 | 5.4 | 0.0002275 | 0.0295755 |
| RV1-22/1730-3 | 1750 | 596 | 6.3 | 147.0 | 5.6 | 5.3 | 0.0000987 | 0.0186865 |
| RV1-22/1800-2 | 1810 | 601 | 6.4 | 145.9 | 5.6 | 5.3 | 0.0004496 | 0.0433671 |
| RV1-22/1800-3 | 1820 | 597 | 6.2 | 149.2 | 5.7 | 5.4 | 0.0002672 | 0.0356714 |
| RV1-22/1830-2 | 1840 | 601 | 5.5 | 150.7 | 5.8 | 5.4 | 0.0000451 | 0.0130868 |
| RV1-22/1830-3 | 1850 | 596 | 5.6 | 153.5 | 5.8 | 5.4 | 0.0001441 | 0.0206693 |



RV1_SUP1 DATA

DATE 12/11/92

ANALYSIS OF RESEARCH VESSEL ONE DATA

TAPE/EVENT NUMBER : RV1-TAPE #14/2007-2 YR/JUL DAY : 1992/56

START TIME (JD/HHMM)---56/ 2017 DURATION 601

WHITECAP AVERAGE : 0.0043953 VARIANCE : 0.0000575

STANDARD DEVIATION: 0.0870834 SKEWNESS : 4.1629006

KURTOSIS : 21.2986728

METEROLOGICAL DATA :

W_S(m/s)
14.4

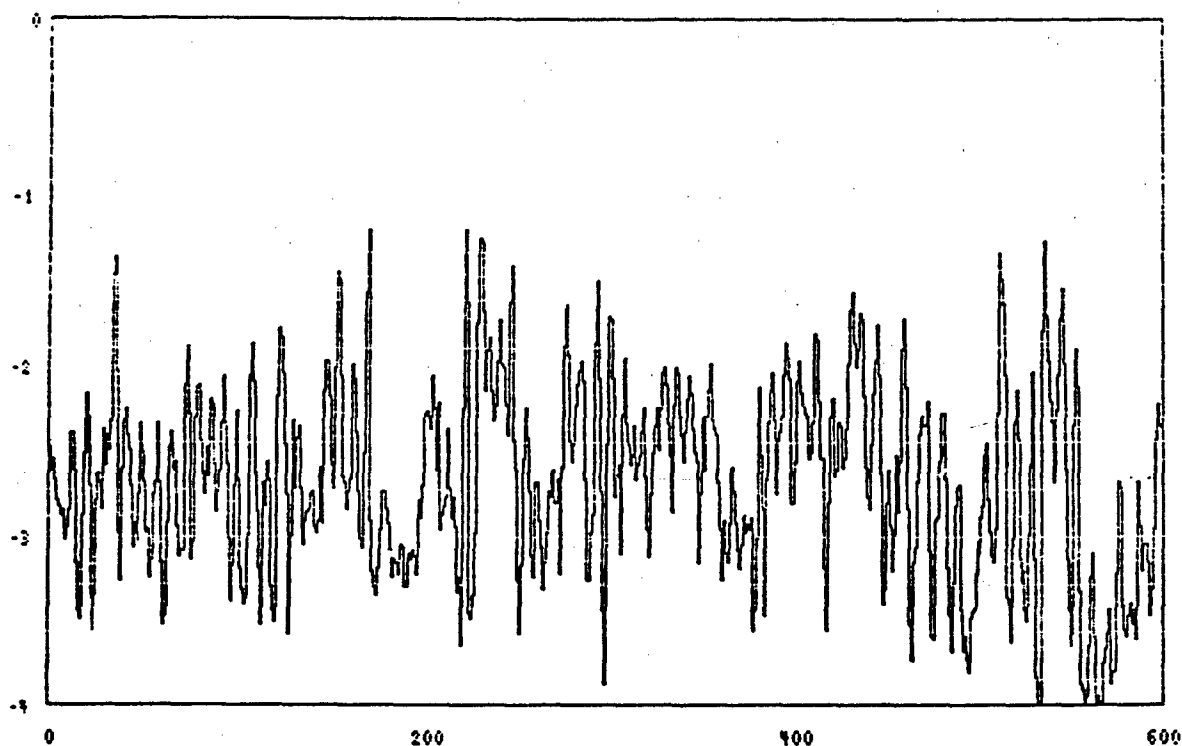
W_D
20.6

T_air
4.3

T_water
5.7

STABILITY
UNSTABLE

LogH vs Time



Time (seconds)

DATE 16/11/92

ANALYSIS OF RESEARCH VESSEL ONE DATA

TAPE/EVENT NUMBER : RV1-TAPE #22/1830-3 YR/JUL DAY : 1992/60

START TIME (JD/HHMM)---60/ 1850 DURATION 596

WHITECAP AVERAGE : 0.0001441 VARIANCE : 0.0000002

STANDARD DEVIATION: 0.0206693 SKEWNESS : 5.5690796

KURTOSIS : 39.9101132

METEROLOGICAL DATA :

W_S(m/s)
5.6

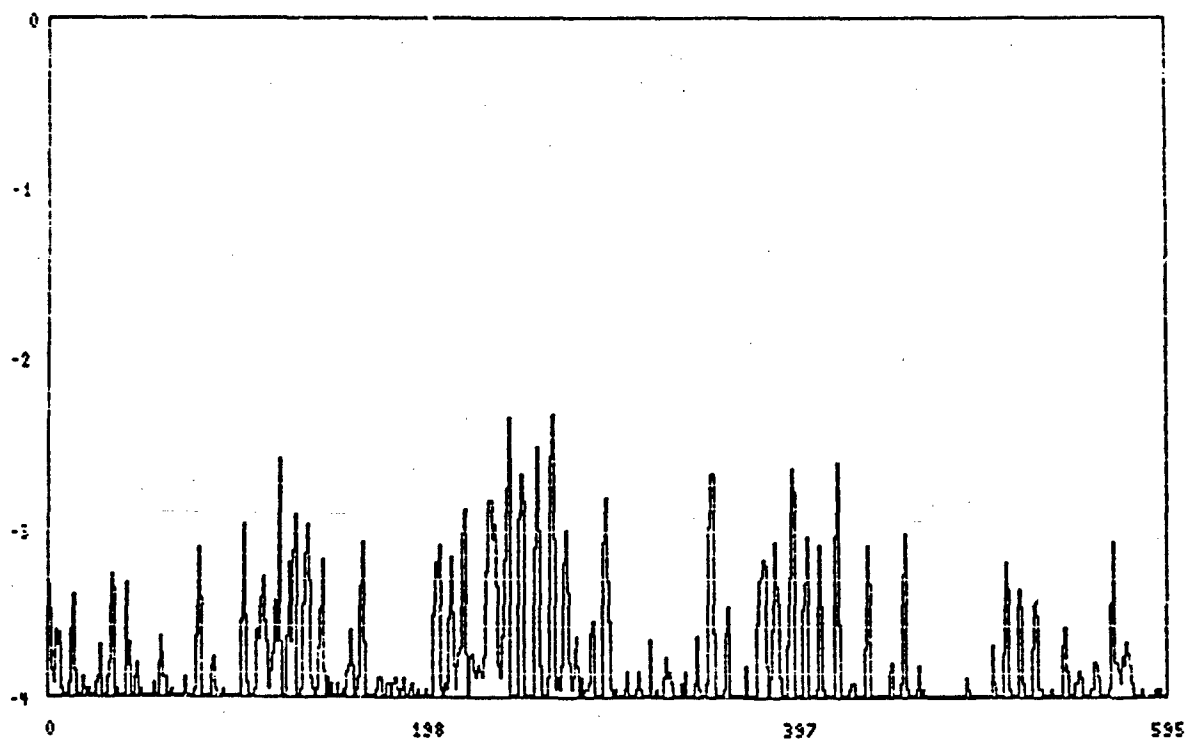
W_D
153.5

T_air
5.8

T_water
5.4

STABILITY
NEUTRAL

LogH vs Time



Time (seconds)

Revision One

November, 1992

The below listing of whitecap fractions, generated from the video records taken on board the R/V J.P. TULLEY, are based upon the latest revision of meteorological data (12/17/92) provided by JHU/APL, and the analysis of all viable intervals recorded during Phase 2 of the Alaskan Gulf test.

Our original report, dated August, 1992, contained seventy nine events analyzed in ten minute segments at approximately thirty minute intervals, conditions permitting. This update reports whitecap fraction for all intervals, with a duration greater than 300 seconds, that were analyzed. Many intervals are contiguous, with a duration of several hours. Others are small time intervals that were able to be analyzed only with difficulty, due to light conditions or weather.

Based upon interpretation of many previous whitecap data sets, and in light of the good agreement with expected results from other research platforms in the immediate area, it is suggested that the wind speeds recorded on board the TULLEY may be in error. Included in this report is our evaluation of expected wind speeds required to generate the evaluated whitecap fraction.

These data are reported under Julian date, MSI tape number, and Run number headings. Each data segment consists of the Observation Number(OBN), which consists of the "Vessel Designation-MSI tape number / file number-interval"; the "Zulu" start time of the interval; the duration of the interval in seconds; the windspeed average(U10, m/s), the wind direction(WD), the air temperatures(ATEMP, Deg C.), and water temperatures(WTEMP, Deg C.). derived from the closest previous meteorological data entry; the whitecap fraction averaged over the stated interval; and the standard deviation of the one second averages of the whitecap fraction over the duration of the data interval.

The one second whitecap averages were derived from the analysis of the video registration made during the test period February/March, 1992. Each second of video recording is made up of thirty images. Five of these were analyzed, and averaged to obtain the one second whitecap average. A number of these one second averages were then averaged to obtain the whitecap fraction over the stated interval.

A graph of (log of the whitecap fraction + 0.0001) verses time for several intervals is also provided.

WHITECAP DATA SET NO:

DATA TYPE: WHITECAP AVERAGES (WA)

SOURCE: GULF OF ALASKA, FEBRUARY / MARCH, 1992
VIDEO DATA FROM CANADIAN RESEARCH VESSEL J.P. TULLEY

CITATION:

NUMBER OF OBSERVATIONS: 183

| OBN | START TIME | DURATION SECS | U10 | WD | ATEMP | WTEMP | WFRAC | STD.DEV. |
|--|---------------|------------------|------|-------|-------|-------|-----------|-----------|
| JULIAN DAY 55, TAPE #9, RUN #92-310/311 | | | | | | | | |
| RV3-9/1640-1 | 1640 | 600 | 9.3 | 169.5 | 7.1 | 5.7 | 0.0022283 | 0.0659856 |
| RV3-9/1640-2 | 1650 | 600 | 9.3 | 169.5 | 7.1 | 5.7 | 0.0009787 | 0.0402410 |
| RV3-9/1640-3 | 1700 | 595 | 10.4 | 175.4 | 7.2 | 5.7 | 0.0025467 | 0.0688394 |
| RV3-9/1710-1 | 1710 | 600 | 10.4 | 176.4 | 7.2 | 5.7 | 0.0012378 | 0.0584512 |
| RV3-9/1710-2 | 1720 | 600 | 10.4 | 176.4 | 7.2 | 5.7 | 0.0013632 | 0.0557823 |
| RV3-9/1710-3 | 1730 | 594 | 11.9 | 185.4 | 7.0 | 5.7 | 0.0018255 | 0.0704822 |
| RV3-9/1740-1 | 1740 | 600 | 11.9 | 185.4 | 7.0 | 5.7 | 0.0025679 | 0.0673368 |
| RV3-9/1810-1 | 1810 | 600 | 11.6 | 178.5 | 7.0 | 5.7 | 0.0029150 | 0.0853688 |
| RV3-9/1810-2 | 1820 | 399 | 11.6 | 178.5 | 7.0 | 5.7 | 0.0021155 | 0.0717987 |
| RV3-9/1955-1 | 1955 | 600 | 10.1 | 177.8 | 6.9 | 5.8 | 0.0072179 | 0.1220106 |
| RV3-9/1955-2 | 2005 | 600 | 9.8 | 143.4 | 6.9 | 5.8 | 0.0036395 | 0.0806942 |
| RV3-9/1955-3 | 2015 | 595 | 9.8 | 143.4 | 6.9 | 5.8 | 0.0024282 | 0.0692435 |
| RV3-9/2025-1 | 2025 | 600 | 9.8 | 143.4 | 6.9 | 5.8 | 0.0031015 | 0.0799125 |
| JULIAN DAY 56, TAPE #10, RUN #92-312/313 | | | | | | | | |
| RV3-10/2043-1 | 2043 | 600 | 18.5 | 184.4 | 3.9 | 5.6 | 0.0042930 | 0.0960975 |
| RV3-10/2136-1 | 2136 | 426 | 17.7 | 349.8 | 4.0 | 5.6 | 0.0044629 | 0.0864424 |
| RV3-10/2143-1 | 2143 | 600 | 17.7 | 349.8 | 4.0 | 5.6 | 0.0038426 | 0.0893107 |
| RV3-10/2143-2 | 2153 | 600 | 17.7 | 349.8 | 4.0 | 5.6 | 0.0080821 | 0.1279188 |
| RV3-10/2143-3 | 2203 | 581 | 16.8 | 305.2 | 4.2 | 5.6 | 0.0052303 | 0.1115265 |
| RV3-10/2223-1 | 2223 | 600 | 16.8 | 305.2 | 4.2 | 5.6 | 0.0064040 | 0.1419490 |
| RV3-10/2223-2 | 2233 | 600 | 15.7 | 251.5 | 4.4 | 5.5 | 0.0028828 | 0.0854350 |
| RV3-10/2223-3 | 2243 | 595 | 15.7 | 251.5 | 4.4 | 5.5 | 0.0021397 | 0.0693543 |
| RV3-10/2253-1 | 2253 | 569 | 15.7 | 251.5 | 4.4 | 5.5 | 0.0032206 | 0.0828732 |
| JULIAN DAY #57 | | | | | | | | |
| RV3-10/1624-1 | 1624 | 569 | 12.1 | 281.7 | 3.0 | 5.5 | 0.0052828 | 0.1210952 |
| RV3-10/1633-1 | 1633 | 384 | 12.2 | 271.2 | 3.3 | 5.6 | 0.0022067 | 0.0858436 |
| RV3-10/1648-1 | 1648 | 356 | 12.2 | 271.2 | 3.3 | 5.6 | 0.0036310 | 0.0908617 |
| RV3-10/1654-1 | 1654 | 600 | 12.2 | 271.2 | 3.3 | 5.6 | 0.0013296 | 0.0712368 |
| RV3-10/1654-2 | 1704 | 600 | 10.9 | 235.8 | 3.2 | 5.7 | 0.0005435 | 0.0471536 |
| RV3-10/1654-3 | 1714 | 595 | 10.9 | 235.8 | 3.2 | 5.7 | 0.0004236 | 0.0370456 |
| RV3-10/1724-1 | 1724 | 600 | 10.9 | 235.8 | 3.2 | 5.7 | 0.0015727 | 0.0695918 |
| RV3-10/1724-2 | 1734 | 600 | 9.5 | 280.6 | 3.2 | 5.7 | 0.0005101 | 0.0352549 |

JULIAN DAY 57, TAPE #10, RUN #91-312/313 (Cont.)

| OBN | START TIME | DURATION SECS | U10 M/S | WD DEG | ATEMP DEG C | WTEMP DEG C | WFRAC | STD.DEV. |
|---------------|---------------|------------------|------------|-----------|----------------|----------------|-----------|-----------|
| RV3-10/1724-3 | 1744 | 595 | 9.5 | 280.6 | 3.2 | 5.7 | 0.0010394 | 0.0589999 |
| RV3-10/1757-1 | 1757 | 301 | 9.5 | 280.6 | 3.2 | 5.7 | 0.0022387 | 0.0614966 |
| RV3-10/1804-1 | 1804 | 600 | 9.5 | 250.5 | 3.8 | 5.7 | 0.0008934 | 0.0519514 |
| RV3-10/1804-2 | 1814 | 600 | 9.5 | 250.5 | 3.8 | 5.7 | 0.0004536 | 0.0334726 |
| RV3-10/1804-3 | 1824 | 595 | 9.5 | 250.5 | 3.8 | 5.7 | 0.0003164 | 0.0319993 |
| RV3-10/1834-1 | 1834 | 600 | 9.6 | 141.4 | 2.9 | 5.7 | 0.0011189 | 0.0623954 |
| RV3-10/1834-2 | 1844 | 600 | 9.6 | 141.4 | 2.9 | 5.7 | 0.0010969 | 0.0615552 |
| RV3-10/1834-3 | 1854 | 595 | 9.6 | 141.4 | 2.9 | 5.7 | 0.0005457 | 0.0531371 |
| RV3-10/1904-1 | 1904 | 601 | 7.1 | 322.7 | 2.9 | 5.7 | 0.0002337 | 0.0272613 |

JULIAN DAY 57, TAPE #11, RUN #92-314

| | | | | | | | | |
|---------------|------|-----|-----|-------|-----|-----|-----------|-----------|
| RV3-11/2024-1 | 2024 | 601 | 8.1 | 270.8 | 3.7 | 5.7 | 0.0006134 | 0.0575886 |
| RV3-11/2045-1 | 2045 | 601 | 9.5 | 288.8 | 3.3 | 5.7 | 0.0008583 | 0.0657565 |
| RV3-11/2045-2 | 2055 | 601 | 9.5 | 288.8 | 3.3 | 5.7 | 0.0010153 | 0.0486471 |
| RV3-11/2045-3 | 2105 | 595 | 9.3 | 275.1 | 3.2 | 5.6 | 0.0003976 | 0.0275470 |
| RV3-11/2115-1 | 2115 | 601 | 9.3 | 275.1 | 3.2 | 5.6 | 0.0002764 | 0.0262088 |
| RV3-11/2115-2 | 2125 | 601 | 9.3 | 275.1 | 3.2 | 5.6 | 0.0010531 | 0.0572571 |
| RV3-11/2115-3 | 2135 | 523 | 6.6 | 274.8 | 3.8 | 5.7 | 0.0003641 | 0.0332252 |
| RV3-11/2144-1 | 2144 | 552 | 6.6 | 274.8 | 3.8 | 5.7 | 0.0000570 | 0.0142522 |
| RV3-11/2155-1 | 2155 | 601 | 6.6 | 274.8 | 3.8 | 5.7 | 0.0000217 | 0.0163373 |
| RV3-11/2226-1 | 2226 | 601 | 7.1 | 301.3 | 2.6 | 5.7 | 0.0000247 | 0.0146638 |
| RV3-11/2256-1 | 2256 | 601 | 4.6 | 308.5 | 2.0 | 5.6 | 0.0000943 | 0.0285904 |
| RV3-11/2326-1 | 2326 | 530 | 5.6 | 334.4 | 3.0 | 5.7 | 0.0000621 | 0.0128394 |
| RV3-11/2334-1 | 2334 | 601 | 4.2 | 326.6 | 3.2 | 5.7 | 0.0000787 | 0.0232590 |

JULIAN DAY 58

| | | | | | | | | |
|---------------|------|-----|-----|-------|-----|-----|-----------|-----------|
| RV3-11/0014-1 | 0014 | 601 | 3.9 | 332.7 | 3.2 | 5.7 | 0.0000268 | 0.0156021 |
| RV3-11/0044-1 | 0044 | 429 | 6.2 | 292.3 | 2.9 | 5.7 | 0.0000259 | 0.0133226 |
| RV3-11/0053-1 | 0053 | 601 | 6.2 | 292.3 | 2.9 | 5.7 | 0.0000287 | 0.0119487 |
| RV3-11/0123-1 | 0123 | 601 | 6.7 | 304.8 | 2.6 | 5.7 | 0.0000034 | 0.0051347 |
| RV3-11/0153-1 | 0153 | 601 | 5.8 | 322.2 | 3.0 | 5.7 | 0.0000200 | 0.0124494 |
| RV3-11/0223-1 | 0223 | 601 | 5.6 | 320.3 | 3.1 | 5.6 | 0.0000069 | 0.0066534 |
| RV3-11/0253-1 | 0253 | 601 | 5.6 | 333.6 | 3.2 | 5.7 | 0.0000009 | 0.0036335 |
| RV3-11/0323-1 | 0323 | 601 | 5.4 | 337.9 | 3.1 | 5.7 | 0.0000003 | 0.0018874 |

JULIAN DAY 58, TAPE #12, RUN #92-315

| | | | | | | | | |
|---------------|------|-----|------|-------|-----|-----|-----------|-----------|
| RV3-12/1636-1 | 1636 | 601 | 11.8 | 309.0 | 2.4 | 5.4 | 0.0009962 | 0.0461041 |
| RV3-12/1636-2 | 1646 | 601 | 11.8 | 309.0 | 2.4 | 5.4 | 0.0007378 | 0.0444412 |
| RV3-12/1636-3 | 1656 | 595 | 11.8 | 309.0 | 2.4 | 5.4 | 0.0010722 | 0.0424057 |
| RV3-12/1706-1 | 1706 | 601 | 12.6 | 309.7 | 1.9 | 5.3 | 0.0018339 | 0.0441860 |
| RV3-12/1717-1 | 1717 | 601 | 12.6 | 309.7 | 1.9 | 5.3 | 0.0012870 | 0.0413295 |
| RV3-12/1717-2 | 1727 | 601 | 12.6 | 309.7 | 1.9 | 5.3 | 0.0003964 | 0.0369946 |
| RV3-12/1717-3 | 1737 | 594 | 10.6 | 294.5 | 2.3 | 5.3 | 0.0003637 | 0.0305593 |
| RV3-12/1747-1 | 1747 | 601 | 10.6 | 294.5 | 2.3 | 5.3 | 0.0011187 | 0.0498624 |

JULIAN DAY 58, TAPE #12, RUN #92-315 (CONT.)

| OBN | START TIME | DURATION SECS | U10 M/S | WD DEG | ATEMP DEG C | WTEMP DEG C | WFRAC | STD.DEV. |
|---------------|---------------|------------------|------------|-----------|----------------|----------------|-----------|-----------|
| RV3-12/1747-2 | 1757 | 601 | 10.6 | 294.5 | 2.3 | 5.3 | 0.0005414 | 0.0256625 |
| RV3-12/1747-3 | 1807 | 595 | 9.8 | 331.9 | 2.5 | 5.3 | 0.0005645 | 0.0430376 |
| RV3-12/1822-1 | 1822 | 601 | 9.8 | 331.9 | 2.5 | 5.3 | 0.0006368 | 0.0389537 |
| RV3-12/1822-2 | 1832 | 601 | 10.4 | 301.0 | 3.5 | 5.4 | 0.0004156 | 0.0395548 |
| RV3-12/1822-3 | 1842 | 595 | 10.4 | 301.0 | 3.5 | 5.4 | 0.0002475 | 0.0250395 |
| RV3-12/1852-1 | 1852 | 601 | 10.4 | 301.0 | 3.5 | 5.4 | 0.0007709 | 0.0454550 |
| RV3-12/1852-2 | 1902 | 601 | 9.7 | 300.8 | 3.7 | 5.4 | 0.0002731 | 0.0286809 |
| RV3-12/1852-3 | 1912 | 595 | 9.7 | 300.8 | 3.7 | 5.4 | 0.0004981 | 0.0359134 |
| RV3-12/1922-1 | 1922 | 601 | 9.7 | 300.8 | 3.7 | 5.4 | 0.0004230 | 0.0285352 |
| RV3-12/1922-2 | 1932 | 601 | 10.3 | 285.3 | 3.7 | 5.6 | 0.0004985 | 0.0316352 |
| RV3-12/1922-3 | 1942 | 569 | 10.3 | 285.3 | 3.7 | 5.6 | 0.0005607 | 0.0330920 |
| RV3-12/2057-1 | 2057 | 601 | 10.5 | 225.1 | 1.9 | 5.5 | 0.0010509 | 0.0662090 |
| RV3-12/2057-2 | 2107 | 601 | 9.6 | 341.9 | 1.0 | 5.5 | 0.0002645 | 0.0283571 |
| RV3-12/2057-3 | 2117 | 595 | 9.6 | 341.9 | 1.0 | 5.5 | 0.0000001 | 0.0009567 |
| RV3-12/2127-1 | 2127 | 601 | 9.6 | 341.9 | 1.0 | 5.5 | 0.0000544 | 0.0115570 |
| RV3-12/2143-1 | 2143 | 601 | 10.7 | 338.3 | 2.6 | 5.5 | 0.0000411 | 0.0193459 |
| RV3-12/2232-1 | 2232 | 601 | 8.1 | 168.3 | 4.7 | 5.5 | 0.0004263 | 0.0343559 |
| RV3-12/2232-1 | 2232 | 601 | 11.2 | 300.4 | 2.7 | 5.5 | 0.0004263 | 0.0343559 |
| RV3-12/2232-2 | 2242 | 601 | 11.2 | 300.4 | 2.7 | 5.5 | 0.0003620 | 0.0606859 |
| RV3-12/2256-1 | 2256 | 397 | 11.2 | 300.4 | 2.7 | 5.5 | 0.0000674 | 0.0236871 |

JULIAN DAY 59

| | | | | | | | | |
|---------------|------|-----|-----|-------|-----|-----|-----------|-----------|
| RV3-12/0017-1 | 0017 | 601 | 7.8 | 237.6 | 3.1 | 5.3 | 0.0006034 | 0.0418029 |
| RV3-12/0017-2 | 0027 | 601 | 7.8 | 237.6 | 3.1 | 5.3 | 0.0001768 | 0.0183709 |
| RV3-12/0017-3 | 0037 | 595 | 8.0 | 268.9 | 3.3 | 5.5 | 0.0006458 | 0.0449397 |

JULIAN DAY 59, TAPE #13, RUN #92-316/317

| | | | | | | | | |
|---------------|------|-----|-----|-------|-----|-----|-----------|-----------|
| RV3-13/0054-1 | 0054 | 601 | 8.0 | 268.9 | 3.3 | 5.5 | 0.0001795 | 0.0224357 |
| RV3-13/0054-2 | 0104 | 600 | 7.8 | 297.4 | 3.1 | 5.5 | 0.0000113 | 0.0088889 |
| RV3-13/0124-1 | 0124 | 601 | 7.8 | 297.4 | 3.1 | 5.5 | 0.0002018 | 0.0285219 |
| RV3-13/0124-2 | 0134 | 601 | 8.6 | 224.8 | 2.9 | 5.6 | 0.0001193 | 0.0191112 |
| RV3-13/0124-3 | 0144 | 595 | 8.6 | 224.8 | 2.9 | 5.6 | 0.0001644 | 0.0347159 |
| RV3-13/0154-1 | 0154 | 601 | 8.6 | 224.8 | 2.9 | 5.6 | 0.0000923 | 0.0227704 |
| RV3-13/0154-2 | 0204 | 601 | 7.4 | 289.5 | 2.9 | 5.6 | 0.0000115 | 0.0098914 |
| RV3-13/0154-3 | 0214 | 595 | 7.4 | 289.5 | 2.9 | 5.6 | 0.0003106 | 0.0516412 |
| RV3-13/0234-1 | 0234 | 601 | 7.8 | 291.0 | 2.7 | 5.4 | 0.0000008 | 0.0026424 |
| RV3-13/0304-1 | 0304 | 601 | 5.3 | 304.3 | 2.7 | 5.5 | 0.0000208 | 0.0137568 |
| RV3-13/0304-2 | 0314 | 601 | 5.3 | 304.3 | 2.7 | 5.5 | 0.0000215 | 0.0104927 |
| RV3-13/0304-3 | 0324 | 595 | 5.3 | 304.3 | 2.7 | 5.5 | 0.0000199 | 0.0160140 |
| RV3-13/0334-1 | 0334 | 601 | 6.3 | 282.6 | 2.7 | 5.5 | 0.0001058 | 0.0226823 |
| RV3-13/0334-2 | 0344 | 601 | 6.3 | 282.6 | 2.7 | 5.5 | 0.0000208 | 0.0138575 |
| RV3-13/0334-3 | 0354 | 328 | 6.3 | 282.6 | 2.7 | 5.5 | 0.0000000 | 0.0138575 |
| RV3-13/1651-1 | 1651 | 520 | 5.6 | 156.6 | 3.2 | 5.3 | 0.0000037 | 0.0056943 |
| RV3-13/1707-1 | 1707 | 601 | 5.0 | 34.7 | 3.1 | 5.2 | 0.0000033 | 0.0050684 |
| RV3-13/1818-1 | 1818 | 601 | 5.3 | 112.7 | 4.1 | 5.3 | 0.0000302 | 0.0134682 |

JULIAN DAY 59, TAPE #13, RUN #92-316/317 (CONT.)

| OBN | START TIME | DURATION SECS | U10 M/S | WD DEG | ATEMP DEG C | WTEMP DEG C | WFRAC | STD.DEV. |
|---------------|---------------|------------------|------------|-----------|----------------|----------------|-----------|-----------|
| RV3-13/1818-2 | 1828 | 601 | 5.3 | 112.7 | 4.1 | 5.3 | 0.0000000 | 0.0009028 |
| RV3-13/1836-1 | 1836 | 601 | 6.2 | 87.7 | 3.8 | 5.3 | 0.0000061 | 0.0077628 |
| RV3-13/1836-2 | 1846 | 601 | 6.2 | 87.7 | 3.8 | 5.3 | 0.0000012 | 0.0029052 |
| RV3-13/1836-3 | 1856 | 589 | 6.2 | 87.7 | 3.8 | 5.3 | 0.0000041 | 0.0052048 |
| RV3-13/1906-1 | 1906 | 601 | 5.4 | 90.8 | 3.7 | 5.3 | 0.0000102 | 0.0054840 |
| RV3-13/1905-2 | 1916 | 601 | 5.4 | 90.8 | 3.7 | 5.3 | 0.0000341 | 0.0131270 |
| RV3-13/1906-3 | 1926 | 595 | 5.4 | 90.8 | 3.7 | 5.3 | 0.0000537 | 0.0157912 |
| RV3-13/1936-1 | 1936 | 601 | 6.9 | 135.4 | 3.9 | 5.3 | 0.0000362 | 0.0113091 |
| RV3-13/1936-2 | 1946 | 601 | 6.9 | 135.4 | 3.9 | 5.3 | 0.0000289 | 0.0095763 |
| RV3-13/1936-3 | 1956 | 595 | 6.9 | 135.4 | 3.9 | 5.3 | 0.0001300 | 0.0207860 |
| RV3-13/2006-1 | 2006 | 601 | 7.9 | 135.5 | 4.2 | 5.3 | 0.0000546 | 0.0133128 |
| RV3-13/2006-2 | 2016 | 601 | 7.9 | 135.5 | 4.2 | 5.3 | 0.0000478 | 0.0119139 |
| RV3-13/2006-3 | 2026 | 595 | 7.9 | 135.5 | 4.2 | 5.3 | 0.0001051 | 0.0157132 |
| RV3-13/2036-1 | 2036 | 601 | 8.0 | 112.8 | 4.3 | 5.5 | 0.0000903 | 0.0142703 |
| RV3-13/2036-2 | 2046 | 601 | 8.0 | 112.8 | 4.3 | 5.5 | 0.0001191 | 0.0178119 |
| RV3-13/2057-1 | 2057 | 601 | 8.0 | 112.8 | 4.3 | 5.5 | 0.0000595 | 0.0167849 |

JULIAN DAY 59, TAPE#14, RUN #92-318

| | | | | | | | | |
|---------------|------|-----|-----|-------|-----|-----|-----------|-----------|
| RV3-14/2130-1 | 2130 | 601 | 8.9 | 61.7 | 4.6 | 5.5 | 0.0001368 | 0.0210462 |
| RV3-14/2130-2 | 2140 | 601 | 8.9 | 61.7 | 4.6 | 5.5 | 0.0002016 | 0.0231316 |
| RV3-14/2130-3 | 2150 | 595 | 8.9 | 61.7 | 4.6 | 5.5 | 0.0000632 | 0.0131882 |
| RV3-14/2200-1 | 2200 | 601 | 6.9 | 101.1 | 4.0 | 5.4 | 0.0001503 | 0.0207920 |
| RV3-14/2200-2 | 2210 | 601 | 6.9 | 101.1 | 4.0 | 5.4 | 0.0000283 | 0.0123272 |
| RV3-14/2200-3 | 2220 | 594 | 6.9 | 101.1 | 4.0 | 5.4 | 0.0000324 | 0.0139659 |
| RV3-14/2235-1 | 2235 | 601 | 8.1 | 168.3 | 4.7 | 5.5 | 0.0001087 | 0.0214924 |
| RV3-14/2235-2 | 2245 | 541 | 8.1 | 168.3 | 4.7 | 5.5 | 0.0000357 | 0.0122704 |
| RV3-14/2235-3 | 2255 | 594 | 8.1 | 168.3 | 4.7 | 5.5 | 0.0000000 | 0.0122704 |
| RV3-14/2305-1 | 2305 | 601 | 7.5 | 128.1 | 4.7 | 5.6 | 0.0001047 | 0.0171870 |
| RV3-14/2305-2 | 2315 | 601 | 7.5 | 128.1 | 4.7 | 5.6 | 0.0000666 | 0.0131958 |
| RV3-14/2305-3 | 2325 | 594 | 7.5 | 128.1 | 4.7 | 5.6 | 0.0000033 | 0.0045560 |
| RV3-14/2337-1 | 2337 | 601 | 7.6 | 204.0 | 4.7 | 5.4 | 0.0001036 | 0.0228252 |
| RV3-14/2337-2 | 2347 | 601 | 7.6 | 204.0 | 4.7 | 5.4 | 0.0002076 | 0.0319764 |

JULIAN DAY 60

| | | | | | | | | |
|---------------|------|-----|-----|-------|-----|-----|-----------|-----------|
| RV3-14/0000-1 | 0000 | 601 | 9.1 | 148.1 | 5.1 | 5.3 | 0.0000438 | 0.0132225 |
| RV3-14/0000-2 | 0010 | 601 | 9.1 | 148.1 | 5.1 | 5.3 | 0.0000046 | 0.0051897 |
| RV3-14/0000-3 | 0020 | 595 | 9.1 | 148.1 | 5.1 | 5.3 | 0.0000086 | 0.0082813 |
| RV3-14/0030-1 | 0030 | 601 | 7.6 | 85.9 | 5.6 | 5.5 | 0.0000295 | 0.0124840 |
| RV3-14/0030-2 | 0040 | 601 | 7.6 | 85.9 | 5.6 | 5.5 | 0.0000101 | 0.0060211 |
| RV3-14/0030-3 | 0050 | 595 | 7.6 | 85.9 | 5.6 | 5.5 | 0.0000500 | 0.0114147 |
| RV3-14/0100-1 | 0100 | 601 | 8.9 | 122.1 | 5.0 | 5.5 | 0.0000833 | 0.0165355 |
| RV3-14/0100-2 | 0110 | 601 | 8.9 | 122.1 | 5.0 | 5.5 | 0.0000233 | 0.0084292 |
| RV3-14/0100-3 | 0120 | 595 | 8.9 | 122.1 | 5.0 | 5.5 | 0.0000321 | 0.0096358 |
| RV3-14/0130-1 | 0130 | 601 | 8.4 | 128.1 | 4.9 | 5.6 | 0.0000433 | 0.0111006 |
| RV3-14/0130-2 | 0140 | 601 | 8.4 | 128.1 | 4.9 | 5.6 | 0.0000867 | 0.0143291 |

JULIAN DAY 59, TAPE#14, RUN #92-318 (CONT.)

| OBN | START TIME | DURATION SECS | U10 M/S | WD DEG | ATEMP DEG C | WTEMP DEG C | WFRAC | STD.DEV. |
|---------------|---------------|------------------|------------|-----------|----------------|----------------|-----------|-----------|
| RV3-14/0130-3 | 0150 | 595 | 8.4 | 128.1 | 4.9 | 5.6 | 0.0000234 | 0.0091069 |
| RV3-14/0200-1 | 0200 | 601 | 9.2 | 209.4 | 5.1 | 5.6 | 0.0001696 | 0.0242613 |
| RV3-14/0200-2 | 0210 | 601 | 9.2 | 209.4 | 5.1 | 5.6 | 0.0000450 | 0.0109633 |
| RV3-14/0200-3 | 0220 | 595 | 9.2 | 209.4 | 5.1 | 5.6 | 0.0000030 | 0.0048134 |
| RV3-14/0241-1 | 0241 | 601 | 8.5 | 41.2 | 5.2 | 5.6 | 0.0000245 | 0.0106935 |
| RV3-14/0241-2 | 0251 | 601 | 8.5 | 41.2 | 5.2 | 5.6 | 0.0000765 | 0.0174569 |
| RV3-14/0241-3 | 0301 | 595 | 8.2 | 34.5 | 4.9 | 5.6 | 0.0000614 | 0.0192242 |
| RV3-14/0311-1 | 0311 | 601 | 8.2 | 34.5 | 4.9 | 5.6 | 0.0000569 | 0.0150111 |
| RV3-14/0311-2 | 0321 | 601 | 8.2 | 34.5 | 4.9 | 5.6 | 0.0000737 | 0.0162512 |
| RV3-14/0311-3 | 0331 | 594 | 9.2 | 123.2 | 4.8 | 5.6 | 0.0000527 | 0.0117284 |
| RV3-14/0341-1 | 0341 | 601 | 9.2 | 123.2 | 4.8 | 5.6 | 0.0004147 | 0.0375790 |
| RV3-14/0341-2 | 0351 | 536 | 9.2 | 123.2 | 4.8 | 5.6 | 0.0000827 | 0.0174192 |

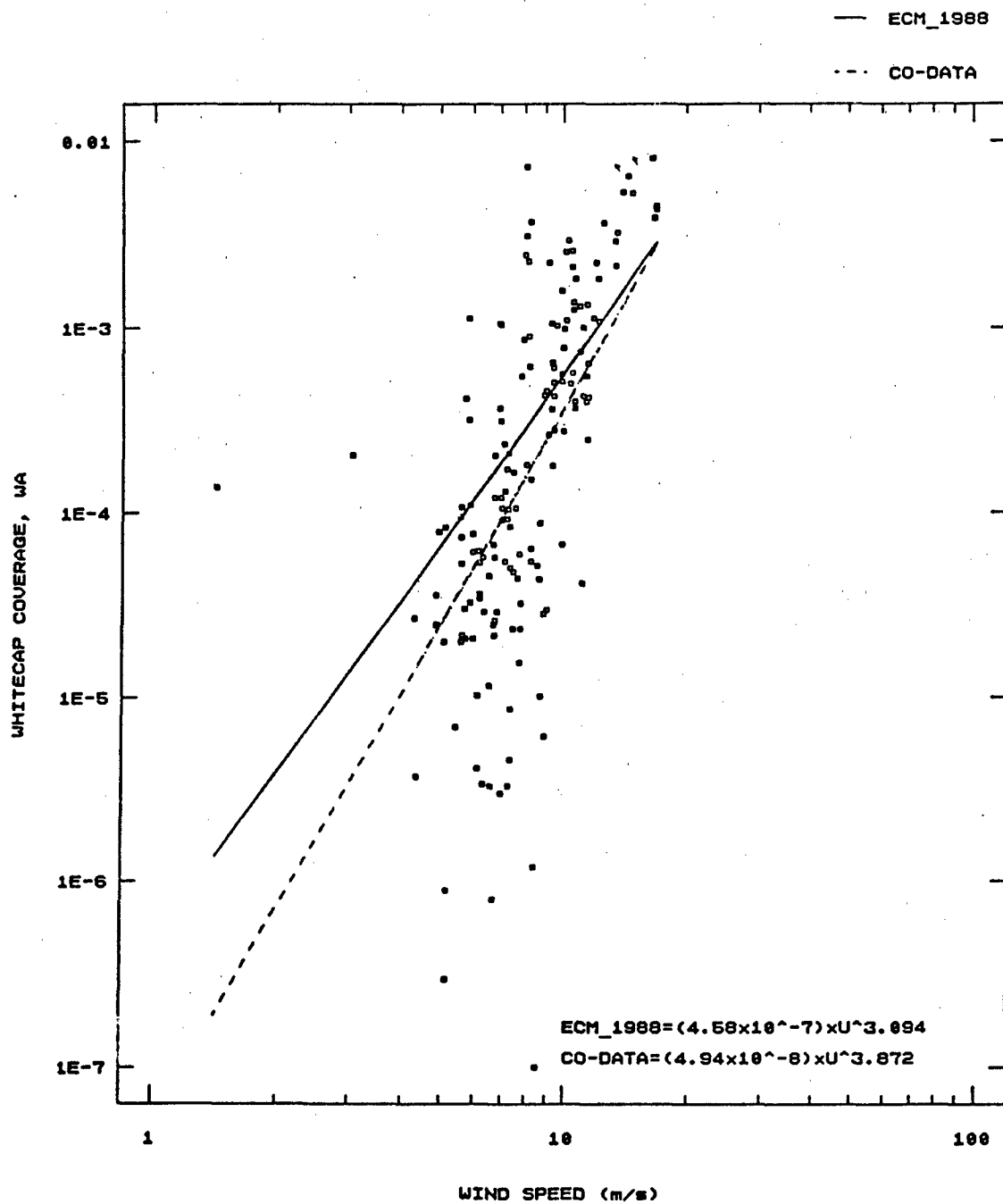
JULIAN DAY 60, TAPE #15, RUN #92-319

| | | | | | | | | |
|---------------|------|-----|-----|-------|-----|-----|-----------|-----------|
| RV3-15/1739-1 | 1739 | 601 | 6.7 | 80.9 | 5.7 | 5.6 | 0.0000054 | 0.0056039 |
| RV3-15/1809-1 | 1809 | 601 | 6.5 | 106.5 | 5.7 | 5.6 | 0.0001218 | 0.0200777 |
| RV3-15/1809-2 | 1819 | 601 | 6.5 | 106.5 | 5.7 | 5.6 | 0.0000202 | 0.0097819 |
| RV3-15/1809-3 | 1829 | 594 | 6.5 | 106.5 | 5.7 | 5.6 | 0.0000776 | 0.0186649 |
| RV3-15/1839-1 | 1839 | 601 | 6.8 | 127.6 | 5.7 | 5.6 | 0.0001025 | 0.0257765 |
| RV3-15/1839-2 | 1849 | 601 | 6.8 | 127.6 | 5.7 | 5.6 | 0.0000964 | 0.0223541 |
| RV3-15/1839-3 | 1859 | 594 | 6.8 | 127.6 | 5.7 | 5.6 | 0.0001700 | 0.0229380 |
| RV3-15/2030-1 | 2030 | 601 | 4.2 | 253.0 | 5.4 | 5.3 | 0.0000233 | 0.0126913 |
| RV3-15/2030-2 | 2040 | 601 | 4.2 | 253.0 | 5.4 | 5.3 | 0.0000137 | 0.0112956 |
| RV3-15/2030-3 | 2050 | 594 | 4.2 | 253.0 | 5.4 | 5.3 | 0.0000009 | 0.0028143 |
| RV3-15/2120-1 | 2120 | 601 | 3.4 | 16.3 | 5.6 | 5.3 | 0.0000002 | 0.0017210 |
| RV3-15/2150-1 | 2150 | 601 | 4.3 | 136.0 | 6.2 | 5.2 | 0.0000000 | 0.0017210 |
| RV3-15/2220-1 | 2220 | 601 | 3.6 | 66.6 | 6.4 | 5.3 | 0.0000002 | 0.0014112 |
| RV3-15/2250-1 | 2250 | 601 | 3.4 | 64.8 | 6.3 | 5.3 | 0.0000004 | 0.0024109 |
| RV3-15/2320-1 | 2320 | 601 | 4.8 | 333.2 | 5.8 | 5.3 | 0.0000001 | 0.0013144 |
| RV3-15/2350-1 | 2350 | 601 | 3.5 | 86.8 | 6.2 | 5.3 | 0.0000001 | 0.0010732 |

JULIAN DAY 61

| | | | | | | | | |
|---------------|------|-----|-----|-------|-----|-----|-----------|-----------|
| RV3-15/0020-1 | 0020 | 601 | 3.7 | 330.3 | 5.9 | 5.3 | 0.0000000 | 0.0010732 |
| RV3-15/0114-1 | 0114 | 601 | 3.4 | 301.4 | 5.6 | 5.6 | 0.0000000 | 0.0006384 |
| RV3-15/0144-1 | 0144 | 456 | 4.4 | 309.2 | 5.5 | 5.6 | 0.0000029 | 0.0069400 |

END OF ANALYSIS, R/V J.P. TULLEY, GULF OF ALASKA



COMBINE DATA

DATE (DD/MM/YY) 3/11/92

ANALYSIS OF RESEARCH VESSEL THREE DATA

TAPE/EVENT NUMBER : RV3-10/2043-1 YR/JUL DAY : 1992/56

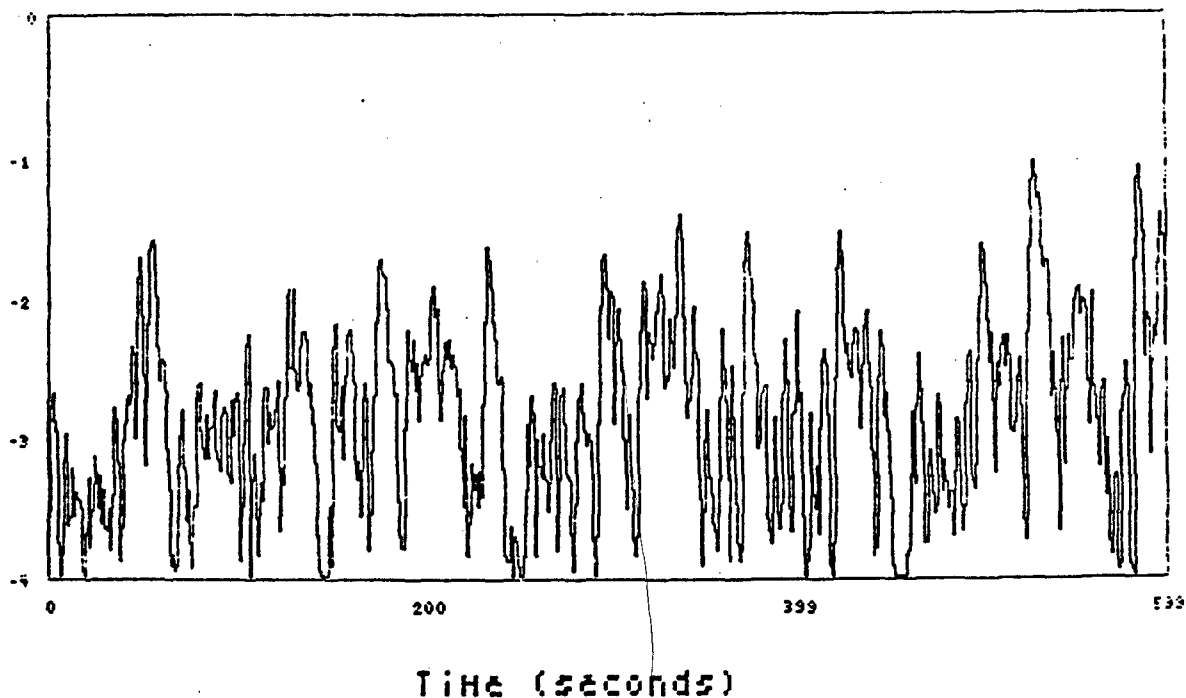
ANALYSIS START TIME (JD/HHMM) --- 56/2043 DURATION 600 SEC.

WHITECAP AVERAGE : 0.0042930 VARIANCE : 0.0000853
STANDARD DEVIATION: 0.0960975 SKEWNESS : 5.0880155
KURTOSIS : 32.7880390

METEOROLOGICAL DATA :

| W _{50m/s} | W _D | T _{air} | T _{water} | STABILITY |
|--------------------|----------------|------------------|--------------------|-----------|
| 18.5 | 184.4 | 3.9 | 5.6 | UNSTABLE |

LogH vs Time



DATE (DD/MM/YY) 4/11/92

ANALYSIS OF RESEARCH VESSEL THREE DATA

TAPE/EVENT NUMBER :RV3-15/0144-1 YR/JUL DAY :1992/61

ANALYSIS START TIME (JD/HHMM)--- 61/144 DURATION 456 SEC.

WHITECAP AVERAGE : 0.0000029 VARIANCE : 0.0000000

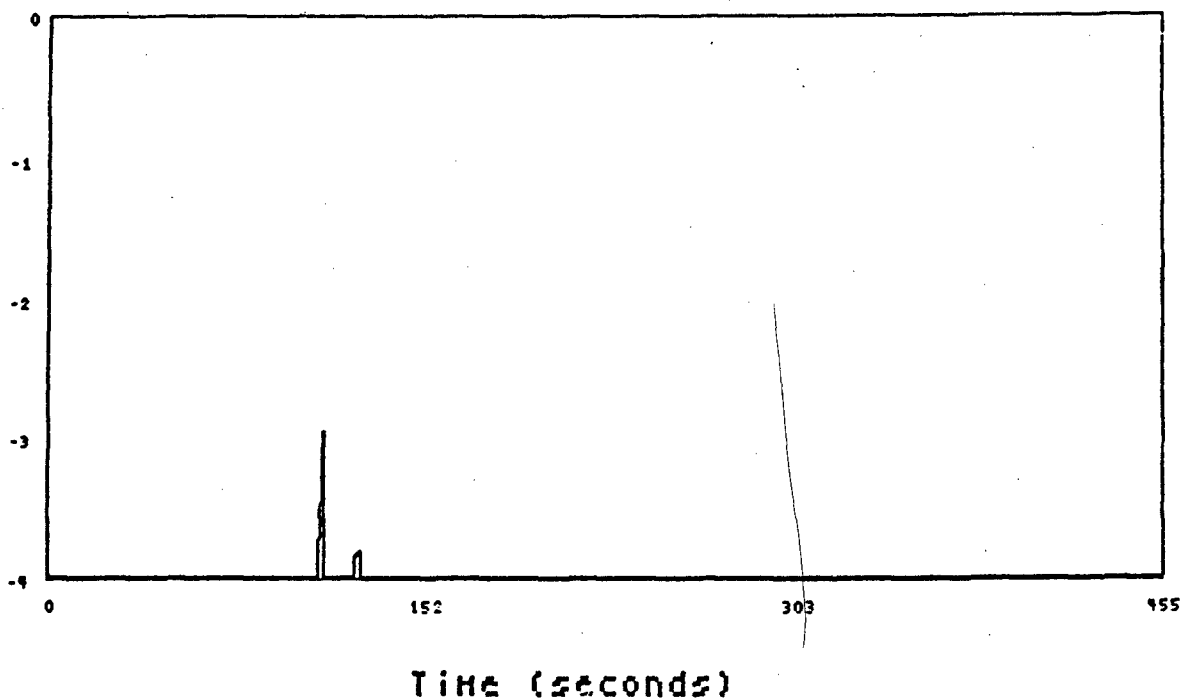
STANDARD DEVIATION: 0.0069400 SKEWNESS : 19.7206137

KURTOSIS :401.0689256

METEROLOGICAL DATA :

| W_S(m/s) | W_D | T_air | T_water | STABILITY |
|----------|-------|-------|---------|-----------|
| 4.4 | 309.2 | 5.5 | 5.6 | NEUTRAL |

LogH vs Time



**END
FILMED**

DATE:

4-93

DTIC